The Enduring Heart

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Big Idea for Physical Education	Big Idea for Science
Lifetime Fitness	Organization and Development of Living Organisms

Standards

SC.5.L.14.1: Identify the organs in the human body and describe their functions, including the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, reproductive organs, kidneys, bladder, and sensory organs.
PE.5.L.4.3: Identify that an increase in heart rate intensity is necessary to enhance cardiorespiratory endurance.

Learning Goals for integrated lesson plan

The student will

- define cardiorespiratory endurance and explain why one would want to improve his/her own endurance.
- explain in his/her own words how the heart and lungs work together as a team and why the heart rate speeds up and respiration increases with increased physical activity.
- explain the functions of the heart, lungs, skeletal muscles, and brain in relation to movement of the body.

Vocabulary common to both disciplines

- heart
- muscles
- lungs
- brain
- cardiorespiratory
- heart rate
- respiration rate
- endurance
- oxygen
- carbon dioxide

Ideas for data collection in Physical Education for use in science classroom

Collect heart rate rate data manually (taking pulse with fingers) or using Heart Rate Monitors. The data can be used as part of a science experiment in the science classroom. If the data is taken over a period of time, the question could focus on some of the concepts embedded in the Physical Education standards. Some suggestions are:

- What do you notice about your heart rate as your cardiorespiratory endurance increases?
- How is heart rate affected as you get older? (Team up with a primary grade level.)
- How is heart rate affected by different activities i.e (basketball vs volleyball or push ups vs squats)?

Summary of Science Investigation	Summary of Physical Education Activity
The students will walk through a model of the heart/lung/muscle/brain as a blood cell, carrying oxygen to the muscles and bringing carbon dioxide back to the lungs to expel.	Students will participate in an activity that enhances and supports students' understanding of the parts, structures and functions of the heart.

These lessons were developed by Brevard Public Schools,
in partnership with the Florida Department of Education's Office of Healthy Schools and Florida's Title IV- Part A Office.

Assessment Tools - Science	Assessment Tools - PE
After the lesson, have the students pick one of the organs in the model (heart, lungs, brain) and write a response to this question: ***What does your organ have to do to help the body when you increase physical activity? Use evidence from the model to support your answer.***	**Before the activity-** Ask students to take their pulse. Help them find pulse in neck, wrist or using Heart Rate Monitors if available. Have students chart their heart rates over time. Discuss observations. Plickers/Selected Response Questions: Using Plickers cards or another selected response method, ask students the following questions: 1. What 2 organs make up the cardiorespiratory system? a. Heart and arteries b. Lungs and veins c. Arteries and veins d. Heart and lungs 2. When blood returns to the heart from the body, which chamber does it enter first? a. Right atrium b. Right ventricle c. Left atrium d. Left ventricle 3. What happens to blood when it is in the lungs? a. It drops off oxygen and picks up carbon dioxide b. It drops of carbon dioxide and picks up oxygen c. It drops off red blood cells and picks up white blood cells d. It picks up nutrients and drops off waste 4. As you perform exercises that increase your heart rate over a period of time, what will happen to your cardiorespiratory endurance? a. It will increase b. It will decrease c. It will stay the same
Integrated Assessment	
Prompt: *How do the organs of your body work together to increase cardiorespiratory fitness? Use evidence from both science and Physical Education investigations to support your answer.*	

Science Investigation: Functional Heart

Duration of Lesson

1 hour of teacher prep to set up the model, 45-60 minutes with students in the model

Materials

- heart model map (attached at end of lesson)
- masking tape (Red, blue, and black electrical tape is an even better choice, as it is flexible and you can use the colors to make a visual representation of what the blood should be carrying--more on this later.)
- red paper (for oxygen cards, signs, and arrows)
- blue paper (for carbon dioxide cards, signs, and arrows)
- 6 containers (about the size of a shoebox or large bowl)
- 1 sheet of pink paper
- 6 student desks

Teacher Notes

NOTE: While the model is of the circulation system, the focus of this lesson is on the function of each individual organ, not the system--that's a 6th grade benchmark. As you work through the model, focus on each organ's function and how that function helps the body.

Safety

Since students are moving around in their socks, it could be a little slippery. Remind them to move carefully throughout the demonstration, especially when they are entering and exiting the capillary areas. Also remind them to duck their heads as they crawl under the desks (capillaries).

Procedure

Preparation:
You will be making a giant model of the circulation system on the floor of the classroom or another large area. The space should be about 25 feet long x 15 feet wide. Follow the illustration attached to this lesson as the plan for the model. Masking tape can be used for all lines, but the colored electrical tape works really well; use the illustration for the color placement. Place the desks so the students can crawl through them, one student at a time.

1. Cut about 240 small rectangles from 10 sheets of red paper (suggestion: 4 strips vertically and 6 pieces horizontally for a total of 24 cards per sheet of paper). These are your oxygen cards.
2. Repeat step 1 with 10 sheets of blue paper. These are your carbon dioxide cards.
3. Out of the red paper, make larger rectangles (about ½ page size). On these rectangles, print the following:
    a. left atrium (1)
    b. left ventricle (1)
    c. aorta (1)
    d. artery (3-4 of these, depending on the size of your model)
    e. capillary (3)
    f. on 10 sheets, draw large arrows (you can also use the colored electrical tape to make the arrows directly on the floor).
4. Out of the blue paper, make large rectangles (about ½ page size). On these rectangles, print the following:

a. right atrium (1)
b. right ventricle (1)
c. vena cava (1)
d. vein (3-4 of these, depending on the size of your model)
e. capillary (3)
f. on 10 sheets, draw large arrows

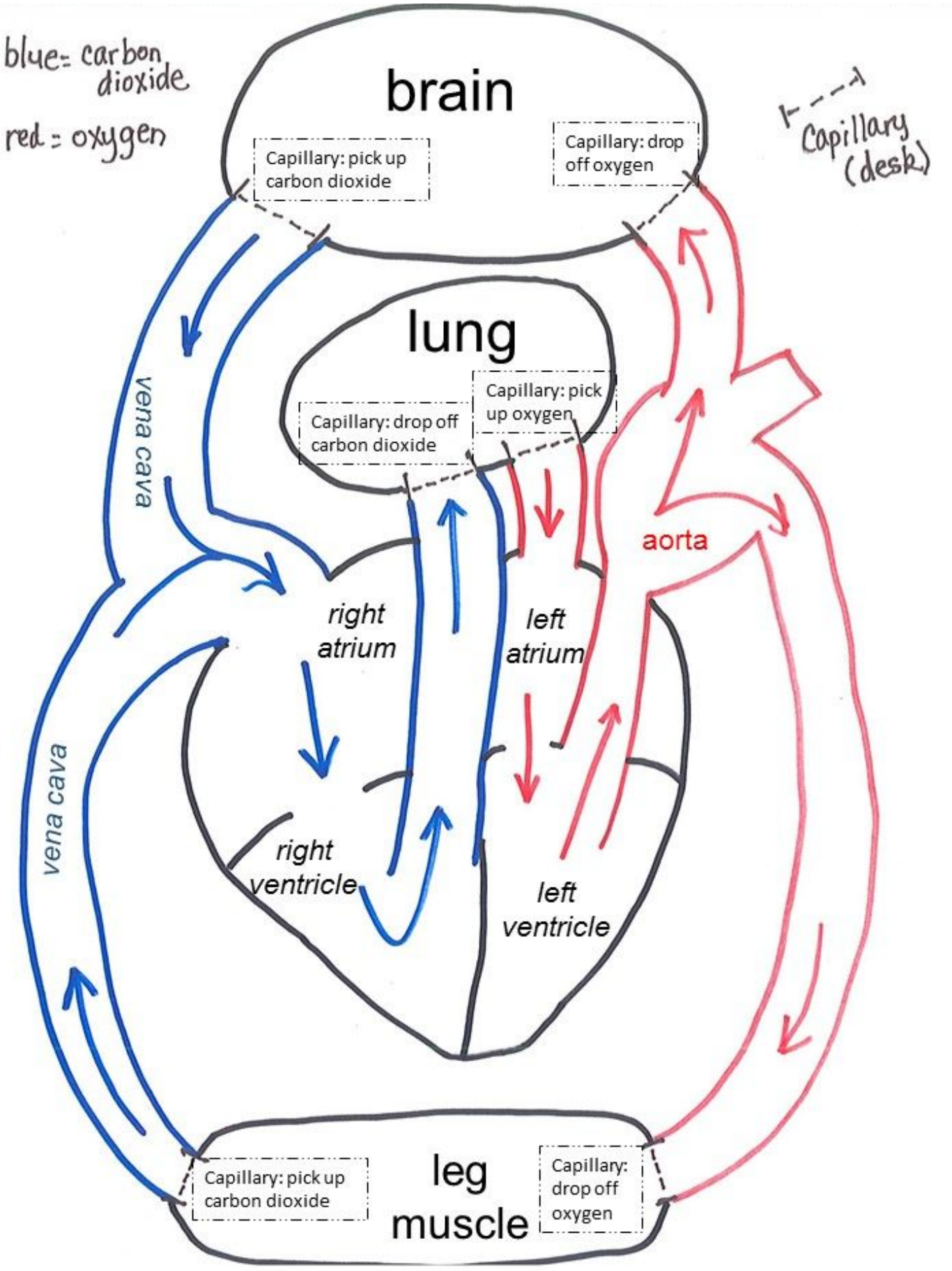
5. Split the pink paper in thirds. On one piece, write “lung.” On the another piece, write “leg muscle.” On the third piece, write “brain.”
6. With masking tape, lay out the model of the heart, lungs, leg muscle, and brain as shown on the attached heart model map. Make sure all the areas of the model have enough room for a student to walk through. The aorta and vena cava should have more room, as these areas carry more blood than the capillaries.
7. Place the organ names on the floor; secure with tape. Put the red arrows and blue arrows in the path to keep students moving in the correct direction. Make sure all the oxygenated blood areas are in red and the carbon dioxide-rich areas are in blue (as shown on the map). Pay particular attention to the vessels in and out of the lungs. The pulmonary artery is blue, as the blood is moving OUT of the heart--an artery--but still doesn’t have oxygen yet. The pulmonary vein is red, as the blood is moving INTO the heart--a vein--but now is oxygen-rich. Make sure there are arrows in the chambers of the heart, as that is the area that tends to be the most confusing.
8. Put all the oxygen into one container. Set the oxygen container at the exit from the lungs. Set an empty container at the entrance to the lungs (on top of the capillary desks works best)--see chart for placement.
9. Split the carbon dioxide cards into 2 containers. Set one at the exit from the brain and the other at the exit from the leg muscle. Place an empty container at each of the entrance capillaries for the brain and leg muscle (on top of the capillary desks works best).

Procedure:

1. Bring students into the room and sit them around the outside of the model. Explain that they will be blood cells moving throughout the body. Since blood cells carry things around the body, they, too, will be carrying cards around the body. Show the students the red oxygen cards and blue carbon dioxide cards.
2. Explain the features of the model:
    a. Point out the structures of the body (heart, lungs, leg muscle, brain, blood vessels) without explaining what all the parts do (students will begin to put it together as they repeatedly walk through the model).
    b. Explain that the tape lines are the walls of the structures. If they step on or over the tape, they’ve broken through the walls of the structures and caused a bruise...and just like bruises on their bodies, they have to sit outside the structures until the body is able to re-absorb them. (In other words, they have to wait outside the model until the teacher tells them they can enter the bloodstream again.)
    c. Explain that the capillaries are the smallest blood vessels—only one blood cell at a time can fit into a capillary. As they enter the capillary to an organ, they give up the card they are holding, then pick up a new card at the capillary exiting from the organ.
3. Spread students around the model, distributing them throughout. To begin, hand every student standing in a red section an oxygen card. Give every student standing in a blue section a carbon dioxide card.
4. Slowly start the model by saying that the body is sleeping, so the blood is moving more slowly. As students crawl through the capillaries, make sure they are dropping off the old card and picking up a new one. In the leg muscle and brain, they are dropping off oxygen and picking up carbon dioxide. In the lung, they are dropping off carbon dioxide and picking up oxygen.
5. Stand at the heart and explain that you are the “heartbeat”--you control the movement of the blood cells. When you clap (or tap on the desk), they can move only ONE step (except capillaries—they have to get completely through on the one beat). ***This begins to show that the heart has a heartbeat--the open and close of the pump as it pushes the blood through the body.***

6. Expect a few miscues as you get the system up and running. Once the system is going well, stop the students and ask what they observed about the system:
    a. Lungs are bringing in oxygen and getting rid of carbon dioxide waste from the cells (function of lungs).
    b. Muscles and brain are taking oxygen and giving up carbon dioxide.
    c. What is the heart doing? Get students to realize that the heart beat is the heart squeezing to push all the blood around the body. There's no exchange of oxygen or carbon dioxide in the chambers of the heart--it's simply the pump for the whole system.
7. Do a few more circuits of the model, slowly speeding the system up by speeding up the heartbeat. Ask students what they think the body is doing (waking up, moving around, etc.). The heart is pumping faster now (the increased heartbeat and speed of the blood moving through the body).
8. Stop and ask what happened in the lungs, brain, and leg muscle as the heartbeat increased. Students should see that the organs were getting more oxygen, but also had more carbon dioxide to get rid of. Ask why these are connected (as the body moves more, the muscles need more oxygen; the lungs have to increase breathing to get more oxygen and get rid of the increased carbon dioxide. The heart has to speed up the pumping to get that oxygen out to the muscles. The brain controls the whole system, sending messages to the lungs and heart to increase)
9. If there's time, introduce some anomalies to the system. Without telling the blood cells, stand by the exit of the lungs, handing out the cards at the exit. But instead of giving all oxygen cards, give a carbon dioxide card to every other blood cell. The all have to keep going with the card they have. They still drop off the card (whether blue or red) in the collection box.
10. After a few circuits, stop and show the muscle and brain collection box: they have oxygen, but they also have a lot of carbon dioxide. Lead the students in a discussion of what this does to the health of the organs. Also discuss some of the things that would lead to this (damage to the lungs, illness, etc.). It focuses students' attention on the importance of taking care of their lungs because it affects the entire body.

As a wrap-up, students can watch this video that walks them through the process they just went through: https://www.youtube.com/watch?v=-s5iCoCaofc



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Physical Education: Heart Parts Tag *(modified from US Games OPEN Instant Activity, Heart Tag)*

Duration of Lesson

40 minutes

Materials

- 4 dice
- 20 cones for activity areas
- Pinnies or other means to identify taggers
- 40 poly spots

Teacher Notes

Set-up for main activity:

1. Create 4 playing areas (4 chambers of the heart) with 1 long area in the middle (the lungs).
2. Scatter 10 poly spots in each of the 4 areas.
3. Scatter students in the activity areas.
4. Send 1 student to each chamber with a bean bag to identify them as taggers.

Safety

- Keep your heads up and eyes looking, aware of your surroundings.
- Watch out for others
- Safe Tagging

Procedure

Essential Question: How does oxygen get to your muscles and the rest of your body?

Instant Activity: 4-Chamber Fitness Warm Up

1. Divide the class into 4 equal groups.
2. Use a large area to create with 4 spaces identified by 1-2-3-4 or using cones create a large square divided into 4 smaller squares similar to but separate from the game play set up (below).
3. Each area should have a dice.
4. Each area should have a task card identifying an exercise corresponding to a number from the dice.
5. Students start in one area, roll the dice and perform that exercise. Prior to the “start” signal, have students take their pulse for 15 seconds and multiple by 4 or 30 seconds and multiply by 3 (or note it on their heart rate monitor).
6. On the signal, “Go”, one person from the group rolls the dice and all perform the associated exercise.
7. Once complete they move into the next corresponding area 1 moves to 2, 2 moves to 3, 3 move to 4, and 4 move to 1.
8. Continue for 3-5 minutes.
9. Once time is up, ask students to take their pulse again (15 seconds x 4 or 30 seconds x 2).
10. What do students observe about their heart rates?

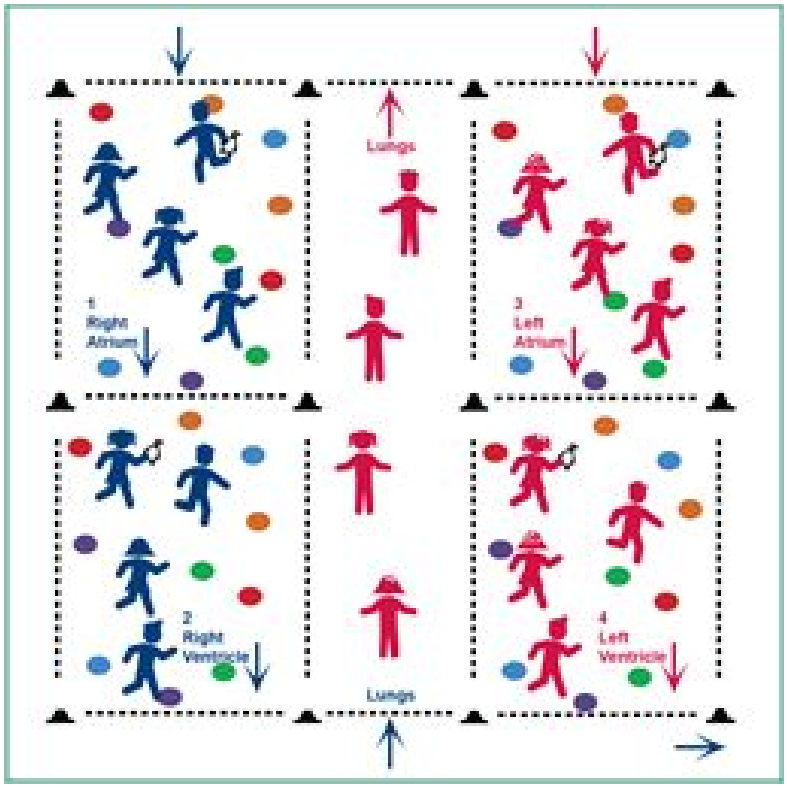
Procedure for Game Play:

1. Today we’re going to play Heart Parts Tag.
2. There are 4 playing areas. These are the different chambers of the heart. The long middle area represents the lungs. You are the blood flowing through the heart.
3. To get through each heart chamber, you must step on five different poly spots (without getting tagged).

Then you can go to the next chamber. Poly spots represent foods that keep your heart healthy from each of the 5 food groups. ***Teaching Tip***: Teach the flow of student movement before adding Taggers.

4. The taggers represent things that can make your heart unhealthy (such as tobacco, sugar, etc..). If you touch 5 spots and make it through the chamber without being tagged, you can move to the next chamber. If you're tagged, though, you must step on 5 more spots before you can continue to the next chamber. Taggers may not re-tag a person in that has already been tagged. When a student enters a new chamber, they can be tagged again.
5. Follow the flow, going from chambers 1-2-3-4. In order to travel from chamber 2 to 3, the blood goes through the lungs to become oxygenated. When you enter the lungs, do 10 jumping jacks, and then move to chamber 3. When you make it through all 4 chambers, circulate around the body by jogging back to chamber 1.
6. On "GO!" begin playing at a speed-walking pace. Freeze on the stop signal and we'll change taggers.

Progression:
Level 1- Have the students play the game as described.
Level 2: Switch the locomotor movement to skip, jog, gallop, etc.
Level 3: Remind students to call out the chamber they are entering (R Atrium, R Ventricle, Lung, L Atrium, L Ventricle).



Closure Questions: (or use Plickers questions from Assessment section)

1. What is the flow of blood when returning from the body?
2. What are some things people do that are NOT good for their hearts?
3. Why are these things bad for our heart?
4. What are some ways that we can keep our heart healthy and strong?
5. How can you improve your cardiorespiratory endurance?

Instant Activity Cards

Area 1 Roll 1 – Hold a plank for 1 minute Roll 2 – 20 Jumping Jacks Roll 3 – 30 High Knees (15 per side) Roll 4 – 16 Lunges (8 per side) Roll 5 – 10 Push Ups Roll 6 – 30 crunches	**Area 2** Roll 1 – 10 Jump Squats Roll 2 – 20 Mountain Climbers Roll 3 – 30 Ski Jumps Roll 4 – 40 Butt Kicks (20 per side) Roll 5 – 15 Burpess Roll 6 – 12 Sumo Squats
Area 3 Roll 1 – 1 minute Jog in Place Roll 2 – 20 Knee Push Ups Roll 3 – 30 Crunches Roll 4 – 40 Calf Raises (20 per side) Roll 5 – 16 Lunges (8 per side) Roll 6 – 12 Squats	**Area 4** Roll 1 – 1 minute Side Plank (30 sec per side) Roll 2 – 20 Scissor Jumps Roll 3 – 30 Ski Jumps Roll 4 – 40 Imaginary Jump Rope Roll 5 – 15 Burpess Roll 6 – 30 Crunches